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Description

A wide variety of processes and compositions have been proposed for forming the gasket in container closures, for instance bottle caps. These include plastisols, solutions in organic solvents, aqueous dispersions (including aqueous latices) and mouldable thermoplastic compositions. They have all been proposed for a variety of container closure types.

The gasket must provide a good seal between the body and the cap so as to prevent inward migration of contaminants or unwanted outward escape of carbon dioxide when the bottle is to contain a carbonated beverage or beer. In order that the beverage does not acquire a flat taste and texture the seal must withstand moderate pressures, for instance up to about 5 and often about 7 bar without venting. It might be thought that it would be desirable for there to be no sensible upper limit on the pressure that the gasket can withstand without venting. In practice however it is desirable for the gasket to vent at a pressure below a pressure at which the bottle will burst. This is because if a beverage bottle is left in an exposed place, for instance hot sunshine, high pressures can be generated spontaneously. It is desirable that the gasket should vent in preference to the bottle shattering. In practice this means that the gasket should vent before the pressure exceeds around 12 or 13 bar.

The ideal gasket for bottles containing beer or carbonated beverages would therefore prevent entry or escape of gases, and would give a good seal at a moderate internal pressure, typically up to about 5 bar, but would vent at a higher pressure that is below the burst pressure of the bottle, and that is typically in the range 5 to 12 or 13 bar.

The steps of lining the gasket into the cap and of subsquently filling and closing the beer bottles are all conducted at very high speed and so it is necessary that the gasket material should be capable of being used in these high speed processes and that it should give uniform results. For instance it is not satisfactory to use a composition that gives a venting pressure of, for instance, 12 bar in some bottles if it is liable to give venting pressures as low as 9 bar or as high as 15 bar in other bottles since a significant number of the bottles would still be liable to burst and this is unacceptable.

A wide variety of processes and compositions have been proposed for forming the gasket in various container closures, for instance bottle caps. These include plastisols, solutions in organic solvents, aqueous dispersions (including aqueous latices) and mouldable thermoplastic compositions. An early disclosure of the use of thermoplastic compositions for forming container closures is in GB-A-1,112,023, GB-A-1,112,024 and GB-A-1,112,025. They describe a wide variety of ways of introducing the compositions into the cap and a wide variety of thermoplastic compositions that can be used.

The closures in GB 1,112,023 were according to Example 1, tested for sealing properties at 3 volume and 5 volume carbonation with storage for 38 °C at 1 month. These tests are conducted at, respectively, 4.3 bar and 7.9 bar and so merely showed that these closures maintained an internal pressure of up to 7.9 bar for one month.

Methods that are described in these three patents include inserting and bonding a preformed uniform disc into the cap, inserting and bonding a preformed contoured disc into the cap, flowing a composition into the cap while rotating it and optionally moulding it, flowing a composition into the cap and moulding it while the composition is still hot, inserting a disc of composition carried on a metal plate, transferring composition by a moulding dye and moulding it into the cap, compression into the cap, and so on. In all the examples, the composition was formed into a sheet, discs were cut from it and the discs were then inserted into the caps and cold moulded into the caps. In many of the examples the inserted disc had a diameter substantially the same as the diameter of the cap.

Thermoplastic compositions that were described include blends of ethylene vinyl acetate copolymer (EVA) and micro crystalline wax, EVA and low density polyethylene (LDPE) having a melt flow index (MFI) of 7, similar blends containing also butyl rubber having Mooney viscosity of 70, a blend of equal amounts of LDPE having MFI 7 with butyl rubber having Mooney 70, blends of different types of EVA, a blend of LDPE with polyisobutylene, a blend of EVA with ethylene propylene copolymer, an ethylene acrylic acid ester copolymer, a blend of this with LDPE, a blend of LDPE with ethylene propylene copolymer, and a blend of LDPE with chloro sulphonated polyethylene.

Various disclosures of forming gaskets from thermoplastic compositions have appeared from time to time since then and these have listed a wide variety of polymers that can be used. Generally, most of the polymers named above have been listed. An example is EP-A-0,331,485 in which molten material is positioned in the cap while still molten (or semi molten) and is moulded into the cap.

In practice, the thermoplastic compositions that have been proposed and used most widely as gaskets for containers are compositions of polyethylenes, ethylene vinyl acetate polymers, and blends thereof. None of the others have attracted any great commercial interest, presumably because of perceived difficulties in

making or using the compositions or in their performance.

An alternative material that has been used very widely is polyvinyl chloride, generally applied as a plastisol, and one advantage of this is that it gives good impermeability to odours and gives good sealing properties, as discussed below. However there is now a desire to avoid the use of polyvinyl chloride in gaskets for containers for consumable materials and so it would be desirable to be able to achieve sealing properties similar to polyvinyl chloride but without its use.

PVC-free sealing compositions for bottle gaskets were described by DS-Chemie in EP-A-0250057.

In Die Brauwelt, 3, 1991, pages 47 and 48 it is stated

"PVC compounds for crown closures are under attack, not only because of their PVC content, but also because of the plasticisers, which are the other main component of the (compound) formula. According to a communication from DS-Chemie, Bremen, PVC-free technology, amongst other, is based on the following raw materials: polyethylene, polypropylene, EVA, various rubber types such as SBS, SIS, butyl-rubber. Depending on the combination of these varous raw materials the properties, essential for the beverage industries, can be obtained".

This article mentioned certain effects such as reduced pressure-holding, oxygen barrier, and chloroanisole barrier effects. No actual compositions are described in the article (which was published after the priority date of this application). The polymers listed in this article are typical of those previously listed for possible use in PVC-free closures and so this article merely outlines the problems and does not offer any solution to these problems.

As indicated, polyethylene and ethylene vinyl acetate copolymers are the materials that have been used most widely for non-PVC gaskets and these and other thermoplastic blends that have been used commercially do not meet the required objectives of a uniform and moderate venting pressure, even though they may give perfectly satisfactory sealing at low pressures for prolonged periods (as described in GB 1,112,025).

Several of the materials described in the literature are rather inconvenient to use in practice, for instance because of difficulties of blending or moulding, and this is one reason why commercial effort has been concentrated primarily on polyethylene and ethylene vinyl acetate copolymers.

We have now found that it is possible to select materials from those that have previously been disclosed and to apply these in a convenient manner, and thereby obtain a gasket that does give a good seal at low pressures but that has a moderate and uniform venting pressure. Although adequate results can be obtained with a composition specifically described in the literature for preforming into a sheet and cutting into discs (Example 7 of GB 1,112,025) the invention includes particularly preferred compositions that differ from this and that give greatly improved results. Also the preparation of preformed discs is unsatisfactory and does not give the desired results.

In GB-A-2108943 injection moulded stoppers for medical containers are described. The stopper is formed of a material which has rubber like elasticity so that it can reseal after being pierced with a needle or cannula. It is said to have oxygen barrier properties. The material includes a blend of 30 to 90% butyl rubber and 70 to 10% of a thermoplastic elastomer. The contents of medical containers are not under pressure and the stopper would be unsuitable to seal a container with pressurised contents.

A method according to the invention of forming in a bottle cap a gasket that provides an effective seal at a moderate pressure of below 7 bar (7×10^5 Pa) but that vents at a higher pressure which is up to 12 bar (1.2×10^6 Pa) comprises inserting heated molten thermoplastic material into the cap and moulding it in the cap and cooling it to form the gasket, and in this method the thermoplastic material is a homogeneous blend of 20 to 60% by weight butyl rubber, which is a copolymer of isoprene and butylene, with 40 to 80% by weight other thermoplastic polymers.

The invention also includes the use of a thermoplastic composition for forming a bottle cap gasket that provides a seal at a moderate pressure of below 7 bar (7×10^5 Pa) but that vents at a higher pressure, which is up to 12 bar (1.2×10^6 Pa) wherein the thermoplastic composition is a substantially homogeneous blend of 20 to 60% by weight butyl rubber, which is a copolymer of isoprene and butylene, with 40 to 80% by weight other thermoplastic polymers.

The invention also includes bottle caps containing such gaskets and bottles sealed with such caps. The caps are preferably crown closures but can be roll-on or screw-on closures. They are preferably metal, but can be plastic. The closure may include a tamper-evident or pilfer-proof feature of any suitable design.

The invention is of particular value for glass bottles that are to be pasteurised.

The bottle may be intended to contain, or may be a closed bottle that does contain, any pressurised potable product, preferably a beverage such as a carbonated beverage or beer. Bottles containing beer are claimed in our copending application no 91305090.2 (EP-A-0478110).

By the invention it is possible to provide an effective seal at a moderate pressure, that is usually below 7 bar (7×10^5 Pa) and preferably below 5 bar (5×10^5 Pa), but that will vent at a higher pressure, which is usually in the range 5 to 12 bar ((5 to 12) $\times 10^5$ Pa), preferably 7 to 12 bar ((7 to 12) $\times 10^5$ Pa).

The amount of butyl rubber is generally at least about 30% but is usually not more than about 50% or 55% by weight of the blend. Amounts of 35 or 40% to 50% are often preferred. Although both low and high molecular weight butyl rubbers can be used, best results are obtained with low molecular weight rubbers, for instance rubbers having a Mooney (ML1+8 at 110°C) of below 50, and generally below 47, for instance in the range about 43 to 47 or lower.

The other thermoplastic polymers in the blend must be selected such that they can be blended with the butyl rubber to form a substantially homogeneous melt which can be extruded and moulded into the cap in a convenient manner to form an adherent gasket having the desired properties. The thermoplastic polymers conventionally mentioned in the literature for thermoplastic gaskets can be used for this purpose and, provided they are blended with butyl rubber in the desired proportions it is relatively easy to select blends that give the surprising combination of moderate but relatively uniform venting pressure.

Preferred thermoplastic materials are polyethylene or ethylene copolymers with butylene, octylene or other lower alkenes, polypropylene, thermoplastic rubbers, ethylene propylene copolymers, acid modified ethylene propylene copolymers, polybutadienes, styrene butadiene rubber, carboxylated styrene butadiene, polyisoprene, styrene isoprene styrene block copolymers, styrene butadiene styrene block copolymers, styrene ethylene butylene styrene block copolymers, polystyrene, ethylene vinyl acetate copolymers, ethylene (meth) acrylate copolymers and ethylene vinyl alcohol copolymers.

Particularly preferred materials comprise polyethylenes. High density polyethylene gives good results, especially when it has melt flow index in the range about 5 to 30. Low density polyethylene can also be satisfactory and although LDPE's having MFI below 10 can be used, it is generally preferred to use LDPE having higher MFI, for instance above 12 and generally above 15, for instance up to around 25.

Blends of butyl with a mixture of 1 part styrene butadiene styrene block copolymer with 3 to 8 parts, often around 5 or 6 parts, polyethylene, generally LDPE, can give particularly good results, especially when the LDPE is a relatively low MFI polymer, typically in the range MFI 5 to 10.

Good results can also be obtained with ethylene propylene rubbers, especially when blended with a mineral oil, generally in the ratio of 1 part oil to 1.5 to 4, often around 2 to 3, parts by weight ethylene propylene rubber.

Blends of polyethylene (usually low density polyethylene), ethylene vinyl acetate copolymer and the butyl rubber can be used but it is generally preferred to form the composition substantially only of polyethylene and butyl rubber.

It is preferred to form a molten mix of the butyl rubber and the thermoplastic polymer or polymers, for instance by melting a preformed mix in a melt extruder and to extrude the mix continuously and to transfer the desired pieces of molten mix direct from the point of extrusion to the individual caps. Processes of this general type are known as the HC (trade mark) cap, the Sacmi (trade mark) and the Zapata (trade mark) processes. Such processes are described in, for instance, US-A-4,277,431, EP-A-0,073,334, US-A-3,705,122 and US-A-4,518,336, and EP-A-0,207,385. It is particularly preferred to conduct the process as described in EP-A-0,331,485.

The dimensions of each cap will be selected according to the dimensions of the bottle and these dimensions, and the amount of thermoplastic composition deposited in each cap, will be conventional.

Example 1

As examples of the invention, blends of the thermoplastic compositions set out below were formed from the respective polymer pellets by melt mixing, and the melt was then inserted into a plurality of bottle crown caps and moulded into annular gaskets, using a commercial lining machine (Sacmi Plastmatic - trade mark).

The lined crowns were closed on to glass bottles containing carbonated water having a carbonation level of 2.7 volumes giving a pressure of 2.2 bar (2.2×10^5 Pa) at room temperature.

After a storage time of 24 hours at room temperature, the venting pressures were measured using an Owens-Illinois Secure Seal tester and the venting pressure for a range of crown closures was observed and the maximum, minimum and mean values were recorded. The results are as follows in which polymer proportions are in parts by weight and pressures (mean, maximum and minimum) are in bars (10^5 Pa).

The polymers are the following.

LDPE1 Low density polyethylene MFI 7, density 0.918 g/ml

LDPE2 Low density polyethylene MFI 20, density 0.918 g/ml

HDPE	High density polyethylene MFI 20, density 0.950 g/ml
Butyl 1	Low m.wt. isoprene/butylene copolymer Mooney (ML1 + 8 at 110 °C) 43-47
Butyl 2	High m.wt. isoprene/butylene copolymer Mooney (ML1 + 8 at 125 °C) 46-56
SBS	Styrene butadiene styrene block copolymer, 29.5% bound styrene
EPM	Ethylene-propylene rubber
OIL	Mineral Oil

Table 1

Polymer	Composition No.							
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
LDPE 1	100	90	80	-	70	-	50	-
HDPE	-	-	-	80	-	70	-	50
Butyl 1	-	10	20	20	30	30	50	50
RESULTS								
Mean	13 +	12.9	10.7	12.8	11.1	10.7	9.8	8.9
Max	13 +	13 +	13 +	13 +	13 +	13 +	11.5	9.5
Min	13 +	11.5	8.5	12.0	8.5	9.5	7.5	7.0

These results indicate that 50% butyl is required to get the maximum venting pressure below 13 bar (1.3 x 10^6 Pa). At this level HDPE is better than LDPE.

Table 2

Polymer	Composition	
	2.2	2.2
LDPE 2	50	50
Butyl 1	50	-
Butyl 2	-	50
Results		
Mean	9.7	10.9
Max	11.5	13 +
Min	7.0	9.0

These results indicate that the lower molecular weight butyl give the better performance.

Table 3

Polymer	Composition	
	3.1	3.2
LDPE 1	85	42.5
SBS	15	7.5
Butyl 1	-	50
Results		
Mean	12.8	8.3
Max	13.0	10.5
Min	12.0	7.0

Table 4

Polymer	Composition	
	4.1	4.2
EPM	70	35
Oil	30	15
Butyl 1	-	50
Results		
Mean	13+	11.7
Max	13+	13+
Min	13+	4.5

Example 2

The final composition (1.8) in Table 1 (50 HDPE, 50 Butyl 1) is used for lining 30 bottles of the size and with the filling shown in Example 1 on a commercial bottling machine. The mean, maximum and minimum values are 6.75, 8.05 and 5.60 bars (10^5 Pa).

Claims

1. A method of forming in a bottle cap a gasket that forms an effective seal at a moderate pressure of below 7 bar (7×10^5 Pa) but that vents at a higher pressure which is up to 12 bar (1.2×10^6 Pa) and which comprises inserting molten heated thermoplastic material into the cap and moulding it in the cap and cooling it to form the gasket, and in which method the thermoplastic material is a homogeneous blend of 20 to 60% by weight butyl rubber, which is a copolymer of isoprene and butylene, with 40 to 80% by weight other thermoplastic polymers.

2. The use of a thermoplastic composition for forming a bottle cap gasket that provides a seal at a moderate pressure of below 7 bar (7×10^5 Pa) but that vents at a higher pressure which is up to 12 bar (1.2×10^6 Pa), wherein the thermoplastic composition is a homogeneous blend of 20 to 60% by weight butyl rubber, which is a copolymer of isoprene and butylene, with 40 to 80% by weight other thermoplastic polymers.

3. A method or use according to claim 1 or claim 2 in which the amount of butyl rubber is from 30 to 50% by weight of the composition

4. A method or use according to any preceding claim in which the butyl rubber has Mooney (ML1+8 at 125°C) of 46-56.

5. A method or use according to any of claims 1 to 3 in which the butyl rubber has Mooney (ML1+8 at 110°C) of below 50.

6. A method or use according to any preceding claim in which the said other thermoplastic polymers are selected from polyethylene, ethylene copolymers with lower alkene, polypropylene, thermoplastic rubbers, ethylene propylene copolymers, acid modified ethylene propylene copolymers, polybutadienes, styrene butadiene rubber, carboxylated styrene butadiene, polyisoprene, styrene isoprene styrene block copolymers, styrene butadiene styrene block copolymers, styrene ethylene butylene styrene block copolymers, polystyrene, ethylene vinyl acetate copolymers, ethylene (meth) acrylate copolymers and ethylene vinyl alcohol copolymers.

7. A method or use according to any preceding claim in which the said other thermoplastic polymer comprises polyethylene.

8. A method or use according to claim 7 in which the polyethylene is high density polyethylene having melt flow index of 5 to 30.

9. A method or use according to claim 7 in which the polyethylene is low density polyethylene having melt flow index 12 to 25.

10. A method or use according to any preceding claim in which the said other thermoplastic polymer comprises a mixture of 1 part styrene butadiene styrene block copolymer with 3 to 8 parts polyethylene.

11. A bottle cap containing a gasket made by a method according to any of claims 1 or 3 to 10.

12. A cap according to claim 11 that is a crown closure.

13. A bottle sealed with a cap according to claim 11 or claim 12.

14. A bottle according to claim 13 in which the seal vents at a pressure less than the pressure at which the bottle shatters.

15. A bottle according to claim 13 or claim 14 and that has been pasteurised.

Patentansprüche

1. Verfahren zur Bildung einer Dichtung in einer Flaschenkappe, wobei die Dichtung eine wirksame Versiegelung bei moderatem Druck von unter 7 bar (7 x 10^5 Pa) bildet, aber bei höherem Druck von bis zu 12 bar (1,2 x 10^6 Pa) undicht wird, und bei dem geschmolzenes, erhitztes thermoplastisches Material in die Kappe eingesetzt wird, es in der Kappe geformt wird und es abgekühlt wird, um die Dichtung zu bilden, wobei das thermoplastische Material eine homogene Mischung aus 20 bis 60 Gew.-% Butylkautschuk, der ein Copolymer aus Isopren und Butylen ist, und 40 bis 80 Gew.-% anderer thermoplastischer Polymere ist.

2. Verwendung einer thermoplastischen Zusammensetzung zur Herstellung einer Flaschenkappendichtung, die bei moderatem Druck von unter 7 bar (7 x 10^5 Pa) eine Versiegelung liefert, aber bei höherem Druck von bis zu 12 bar (1,2 x 10^6 Pa) undicht wird, wobei die thermoplastische Zusammensetzung eine homogene Mischung aus 20 bis 60 Gew.-% Butylkautschuk, der ein Copolymer aus Isopren und Butylen ist, und 40 bis 80 Gew.-% anderer thermoplastischer Polymere ist.

3. Verfahren oder Verwendung nach Anspruch 1 oder Anspruch 2, bei dem/der die Menge an Butylkautschuk bezogen auf das Gewicht der Zusammensetzung 30 bis 50 % ausmacht.

4. Verfahren oder Verwendung nach einem der vorhergehenden Ansprüche, bei dem/der der Butylkautschuk eine Mooney (ML1 + 8 bei 125 °C) von 46 bis 56 aufweist.

5. Verfahren oder Verwendung nach einem der Ansprüche 1 bis 3, bei dem/der der Butylkautschuk eine Mooney (ML1 + 8 bei 110 °C) unterhalb von 50 aufweist.

6. Verfahren oder Verwendung nach einem der vorhergehenden Ansprüche, bei dem/der die anderen thermoplastischen Polymere ausgewählt sind aus Polyethylen, Ethylencopolymeren mit niederem Alken, Polypropylen, thermoplastischen Kautschuken, Ethylen/Propylen-Copolymeren, säuremodifizierten Ethylen/Propylen-Copolymeren, Polybutadienen, Styrol/Butydien-Kautschuk, carboxyliertem Styrol/Butadien, Polyisopren, Styrol/Isopren/Styrol-Blockcopolymeren,Styrol/Butadien/Styrol-Blockcopolymeren,Styrol/Ethylen/Butylen/Styrol-Blockcopolymeren, Polystyrol, Ethylen/Vinylacetat-Copolymeren, Ethylen/(Meth)acrylat-Copolymeren und Ethylen/Vinylalkohol-Copolymeren.

7. Verfahren oder Verwendung nach einem der vorhergehenden Ansprüche, bei dem/der das andere thermoplastische Polymer Polyethylen umfaßt.

8. Verfahren oder Verwendung nach Anspruch 7, bei dem/der das Polyethylen Polyethylen hoher Dichte mit einem Schmelzflußindex von 5 bis 30 ist.

9. Verfahren oder Verwendung nach Anspruch 7, bei dem/der das Polyethylen Polyethylen niederer Dichte mit einem Schmelzfilmindex von 12 bis 25 ist.

10. Verfahren oder Verwendung nach einem der vorhergehenden Ansprüche, bei dem/der das andere thermoplastische Polymer eine Mischung aus einem Teil Styrol/Butydien/Styrol-Blockcopolymer und 3 bis 8 Teilen Polyethylen umfaßt.

11. Flaschenkappe, die eine nach einem Verfahren gemäß einem der Ansprüche 1 oder 3 bis 10 hergestellte Dichtung enthält.

12. Kappe nach Anspruch 11, die ein Kronenverschluß ist.

13. Flasche, die mit einer Kappe nach Anspruch 11 oder Anspruch 12 versiegelt ist.

14. Flasche nach Anspruch 13, bei der die Versiegelung bei einem Druck undicht wird, der niedriger ist als der Druck, bei dem die Flasche splittert.

15. Flasche nach Anspruch 13 oder Anspruch 14, die pasteurisiert worden ist.

Revendications

1. Méthode de formation dans une capsule de bouteille d'un joint qui forme un scellement efficace à une pression modérée inférieure à 7 bars (7 x 10^5 Pa) mais qui laisse passer à une pression plus élevée qui est supérieure à 12 bars (1,2 x 10^6 Pa) et qui comprend l'insertion d'un matériau thermoplastique chauffé fondu dans la capsule et son moulage dans la capsule et son refroidissement pour former le joint, et dans laquelle méthode le matériau thermoplastique est un mélange homogène de 20 à 60% en poids de caoutchouc butyle, qui est un copolymère d'isoprène et de butylène, avec 40 à 80% en poids d'autres polymères thermoplastiques.

2. Utilisation d'une composition thermoplastique pour former un joint de capsule de bouteille qui procure un scellement à une pression modérée inférieure à 7 bars (7 x 10^5 Pa) mais qui laisse passer à une pression supérieure qui est jusqu'à 12 bars (1,2 x 10^6 Pa), dans laquelle la composition thermoplastique est un mélange homogène de 20 à 60% en poids de caoutchouc butyle, qui est un copolymère d'isoprène et de butylène, avec 40 à 80% en poids d'autres polymères thermoplastiques.

3. Méthode ou utilisation selon la revendication 1 ou 2, dans lesquelles la quantité de caoutchouc butyle est de 30 à 50% en poids de la composition.

4. Méthode ou utilisation selon l'une quelconque des revendications précédentes dans lesquelles le caoutchouc butyle a un indice Mooney (ML1 +8 à 125 °C) de 46 à 56.

5. Méthode ou utilisation selon l'une quelconque des revendications 1 à 3 dans lesquelles le caoutchouc butyle a un indice Mooney (ML1 +8 à 110 °C) inférieur à 50.

6. Méthode ou utilisation selon l'une quelconque des revendications précédentes dans lesquelles lesdits autres polymères thermoplastiques sont choisis parmi le polyéthylène, les copolymères d'éthylène avec un alcène inférieur, le polypropylène, les caoutchoucs thermoplastiques, les copolymères éthylène propylène, les copolymères éthylène propylène modifiés par un acide, les polybutadiènes, le caoutchouc styrène butadiène, le butadiène styrène carboxylé, la polyisoprène, les copolymères blocs styrène isoprène styrène, les copolymères blocs styrène butadiène styrène, les copolymères blocs styrène éthylène butylène styrène, le polystyrène, les copolymères éthylène acétate de vinyle, les copolymères éthylène (méth) acrylate et les copolymères éthylène alcool vinylique.

7. Méthode ou utilisation selon l'une quelconque des revendications précédentes dans lesquelles ledit autre polymère thermoplastique comprend le polyéthylène.

8. Méthode ou utilisation selon la revendication 7 dans lesquelles le polyéthylène est un polyéthylène haute densité ayant un indice d'écoulement fondu de 5 à 30.

9. Méthode ou utilisation selon la revendication 7 dans lesquelles le polyéthylène est un polyéthylène basse densité ayant un indice d'écoulement fondu de 12 à 25.

10. Méthode ou utilisation selon l'une quelconque des revendications précédentes dans lesquelles ledit autre polymère thermoplastique comprend un mélange de 1 partie d'un copolymère bloc styrène butadiène styrène avec 3 à 8 parties de polyéthylène.

11. Capsule de bouteille contenant un joint fabriqué par une méthode selon l'une quelconque des revendications 1 ou 3 à 10.

12. Capsule selon la revendication 11 qui est une fermeture en couronne.

13. Bouteille scellée avec une capsule selon la revendication 11 ou la revendication 12.

14. Bouteille selon la revendication 13 dans laquelle le joint laisse passer à une pression inférieure à la pression à laquelle la bouteille vole en éclats.

15. Bouteille selon la revendication 13 ou la revendication 14 et qui a été pasteurisée.